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ECOLOGICAL SURVEY OF THE GRAHAM PINERY CANDIDATE RESEARCH NATURAL AREA, LASSEN NATIONAL FOREST, CALIFORNIA

(Purchase Order # 40-9AD6-0-0303)

Todd Keeler-Wolf

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INTRODUCTION

The Graham Pinery candidate Research Natural Area (GPRNA) is on the Almanor Ranger District of the Lassen National Forest. The area has been recognized as a candidate RNA by the Forest since 1975. In 1983 McDonald, Rhodes, and Westmoreland (see literature cited) conducted a field reconnaissance of the area. Following this reconnaissance, Graham Pinery was formally accepted as a candidate by the Region 5 RNA Committee. The GPRNA was nominated to represent the Pacific ponderosa pine (*Pinus ponderosa*)[1] target element for the Cascade Province of Region 5. However, the reconnaissance report (McDonald et al. 1983a) strongly suggests that the area be considered a joint RNA for ponderosa pine and the California black oak (*Quercus kelloggii*) target elements. As a result of the extensive fire in August 1990 this report recommends stressing the California black oak values while minimizing the ponderosa pine values for target element representation (see impacts and recommendations).

The GPRNA as defined in this report covers 705 acres (285.3 ha). The approximate center of the area is latitude 40°03' N, longitude 121°45' W. The area occupies portions of sections 32, 33, and 34 T 26N, R2E and sections 3 and 4 T 25N, R 2E MDM. Topogrphic map coverage is included on Ishi Caves and Butte Meadows SW (also known as Devil's Parade Grounds), 7.5 minute series. The entire area is included within the Federally designated Ishi Wilderness Area (maps 1 and 2).

Elevations range from about 2200 ft. (670.6 m) on the western side of the Pinery to 2835 ft. (864.1 m) at the highest point along its eastern side. The entire area occupies the top of the gently sloping Graham Pinery with a total elevational relief of 435 ft. (132.6 m).

Access:

The area is accessible from the south via the Cohassett Highway and Forest Road 28N29 from Chico using the following route:

Take the Cohassett Highway north from the city of Chico. Approximately two miles beyond Cohassett the road becomes dirt (28N29) and 8.5 miles past the town of Cohassett it begins descending the north-facing slope of Deer Creek canyon. Approximately 200 m beyond the Campbellville site (a heliport atop a knoll at the beginning of the descent, see map 2), stop at a point where the road rounds the top of a small ridge (small pull-out area). A jeep trail (2E09) descends this ridge. This jeep road (recently widened from fire-fighting bulldozers) eventually becomes a faint trail and after approximatley 1.5 miles (2.4 km) and a 1000 ft. (305 m) descent, reaches the eastern edge of the GPRNA en route to Deer Creek. Travel time from Chico (junction Highway 99E and Cohassett Highway) to the Campbellville site is approximately 40 minutes and is about 23 miles (37 km).

[1] scientific names for plants are in accordance with Munz (1968) unless otherwise mentioned.

Walking time from the edge of 28N29 to the edge of the pinery is about 50 minutes (walking uphill on the return from the e edge of the RNA is about 1 hour 15 minutes).

Travel within the cRNA is facilitated by the very gradual slopes throughout virtually the entire area. In addition, an old, faint jeep track (an extension of the aforementioned jeep road) winds its way from the eastern edge of the area to the western edge, essentially bisecting the pinery from west to east. Following this track it is about 2 miles (3.2 km, and approximately 1 hour) from the se edge of the RNA to the w edge, abutting the private land in sec. 5 T25N, R2E. Steep volcanic escarpments fringe virtually the entire northern edge of the area. These escarpments are bordered by low dense chaparral and scrubby black oak thickets, making access to the northern rim difficult except in a few places. The southern edge also has steep rocky slopes, though it is less precipitous and less heavily vegetated. Access to Wildcat Creek, an intermittent stream dry most of the year, is possible at many points along the southern edge of the pinery. The entire summit plateau was, as of May 1990, easily traversed with very few obstructions caused by dense scrubby vegetation.

PRINCIPAL DISTINGUISHING FEATURES

The Graham Pinery is a remnant of a volcanic peneplain perched along the southern rim of Deer Creek Canyon in the southwestern portion of the Cascade Range physiographic province. The top of the pinery is covered with Cohassett gravelly loam, a relatively deep soil derived from the underlying volcanic mudflow breccias of the Tuscan Formation.

The gently west-sloping summit housed (prior to August 1990) a core area of open, mature ponderosa pine in a mosaic with large-stemmed black oak, smaller, multi-stemmed black oak, and small shrub-dominated and grassy openings. Surrounding this core area is a broad belt of multi-stemmed black oak, which in turn, is bordered by a discontinuous band of chaparral including Green-leaf manzanita (*Arctostaphylos patula),* Brewer oak (*Quercus garryana* ssp. *breweri),* buckbrush (*Ceanothus cuneatus),* and mixed north slope types.

The ponderosa pine core area was, up until early August 1990, dominated by large pines up to 54 inches (137 cm) dbh and 145 ft. (44.2 m) tall (photo 1). These mature pines were between 200 and 400 years old. Following the 131,000 acre (53,014 ha) Campbell Fire, which affected virtually the entire RNA ca. August 8, 1990, the majority of the ponderosa pines were killed. At present, the core area has a layer of largely dead pines forming the canopy with fire-damaged black oak and resprouting shrubs of *Rhamnus rubra* and other species in the understory (photo 2).

The variation in vegetative cover across the top of the essentially level pinery is primarily related to the varying effects of fire in the past. The hot chaparral fires tend to diminish in intensity as they burn through the black oak zone and become cool ground fires in the core area of the pinery. Regular

ground fires promote the development of ponderosa pine stands. It is likely that prior to fire suppression practices, higher fire frequencies were the norm in the pinery. During these periods, the extent of California black oak was reduced relative to ponderosa pine. Prior to the Campbell Fire of 1990 the last fire to affect the area occurred in 1931.

The pinery is near the low elevation extreme of the pacific ponderosa pine belt in this part of the Cascades province. As such, its stability as a vegetation type is affected by long and short-term climatic change, as well as by variation in fire frequency and intensity. The dynamic position of the California black oak and ponderosa pine stands at the pinery is emphasized by the recent fire.

JUSTIFICATION FOR ESTABLISHMENT AND BACKGROUND ON TARGET ELEMENTS

Pacific Ponderosa Pine:

This vegetation type is typically the first coniferous forest encountered with an increase in elevation from the western foothills of the southern Cascades and the Sierra Nevada. Ponderosa pine grows well in the relatively warm, winter-moist climate of the lower mountains of California. Because of the long frost-free period and the summer-dry climate characteristic of the ponderosa pine zone in California, growing seasons are typically long and limited by soil moisture availability (Oliver et al. 1983). In the northern Sierra Nevada at ca. 2600 ft. (792 m) radial growth continues for at least 167 days (Oliver et al., op cit.). The species is characterized by rapid root development. At the end of the first growing season a 1 to 2 inch (2.5-5.0 cm) high seedling may have a 30 inch (76 cm) long root (McDonald 1980a). This attribute, plus rapid early height growth beginning the second growing season, enables seedlings to withstand drought and compete well on sites inadequate for most other conifers. Strong stomatal control of moisture loss also increases drought-tolerance (Oliver et al., op cit.). Seedlings of ponderosa pine are intolerant of deep snow and this factor may be important in explaining its restriction to the lower montane zone in California (Rundel et al 1977).

Although ponderosa pine is adapted to hot, dry summers, growth is greater and continues longer on deep, well-drained soils with moderate water-holding capacities. Thus, stands, particularly at lowest elevations where moisture availability is most limited, tend to occur in favorable environments (McDonald 1980a).

Ponderosa pine is well adapted to light, regular ground fires (Rundel et al. 1977). Bark thickness increases rapidly with age and relatively young trees (50-75 years old) are capable of withstanding most surface fires. Cones are not produced in abundance until a tree is about 50 years old (Peattie 1953). Bark continues to thicken and most specimens begin to show the characteristic platy bark structure before they reach 100 years.

Typical pacific ponderosa pine forest is monospecific and even-aged (Oliver et al 1983). This results

from poor reproduction in shade and regular fire which excludes thinner-barked trees such as Gray pine (*Pinus sabiniana*) at lower elevations and Douglas-fir (*Pseudotsuga menziesii*) and white fir (*Abies concolor*) at upper elevation or more mesic sites. Implicit also in the even-age distribution are the effects of crown fire and/or other wide-ranging disturbance in this community. McDonald (1980a) describes most stands in California as under 125 years old, although ponderosa pine may live for 600 years (Arno 1973).

At Graham Pinery, the ponderosa pine element was represented by multiaged stands including seedlings, saplings, poles, and several ages of large individuals. The larger and older individuals showed evidence of repeated ground fire (cat-faced scars), and trees which averaged only 13-15 inches dbh (33-38 cm, ca. 60-100 years old) at the time of the 1931 fire showed only minor singe marks and appeared healthy in May 1990. Why, then did so many large individuals succUmb to the fire in August 1990?

Several factors are likely to have interacted to cause the widespread death of all ages of pines. At the time of the fire, the area was in its fourth year of below normal precipitation. Moisture content of the soil, the foliage, and the litter layer was likely to have been extremely low. Three months after the fire, despite clear indications of a ground fire throughout much of the ponderosa pine- dominated area, foliage was found to be dessicated (not burned, but dried), in many cases, over 100 ft. (31 m) above the ground. The relatively high litter content of the soil (as a result of 59 years since the last fire), high air temperatures, low humidity and light wind conditions during the fire (Ken Crummer, Almanor District Ranger, Pers. comm. 1991) interacted to cause a hot surface fire which probably lingered long enough to kill the cambium layer, and/or dessicate and kill the foliage of many trees without actually engulfing them in flame. The only places where mature trees were clearly torched were adjacent to dense stands of pole-size trees (photo 3) and in some cases even such dense thickets did not necessarily create fire ladders to the mature canopy (photo 4).

Three months after the fire, about 25% of the mature trees retained green needles in the upper third to fifth of the crown. It remains to be seen how many of these trees will survive for more than just a short time. Only a relatively few individuals (estimated less than 10% of the total number of mature pines in the RNA) were largely un-affected or had dead foliage in only the lower half of the tree. These trees will act as the major recolonizing source for the area.

Good cone crops for ponderosa pines are regionally uncommon in California, but are more frequent at specific locations (Oliver et al 1983). On the average, medium-to-better crops appear every 1 to 3 years. Following the 1990 fire, it is likely that seedlings will establish over a period of several years when surface light level is high (before regrowth of black oak stems and understory shrubs). Presumably the density of nitrogen fixing *Ceanothus lemmonii* and *C. cuneatus* will increase following the fire and provide important fertilizer for the young pines (low nitrogen is often a problem

for young even-aged stands, Oliver et al, op. cit.). Under such normal conditions the ponderosa pine stands at GPRNA will re-dominate the core area within 100 years, although the structure of the forest will not resemble pre-August 1990 conditions for perhaps 200 years. At that time, under similar climatic conditions to the present, the canopy will be dominated by the 200 year old cohort (appreciably thinned from the original stocking level by fire, disease and shading) with a few large 400+ year old survivors of the 1990 fire.

The current value of the ponderosa pine component at GPRNA is thus, not as a well-developed example of the forest type, but as a natural laboratory for regeneration. Vegetation sampling and photographic documentation of the condition of the stands immediatley prior to the 1990 fire will provide a benchmark by which can be measured secondary succesional rates and trends.

The Pacific ponderosa pine forest type is a productive, relatively narrow forest belt, which has been heavily exploited for lumber. Destructive fires and logging have altered and converted lower elevation sites to chaparral and California black oak types, while along the upper elevation margin as a result of selective logging and fire suppression many areas are converting to the Sierra Nevada mixed conifer type. Thus, the type has become scarse in its humanly-unaltered state.

Three other RNAs in the region are designated to represent the Pacific ponderosa pine type. Two of these occur in the Sierra Nevada and one in the Cascades province. Brief comparisons with these other areas will aid in pin-pointing additional values and unique attributes of the GPRNA.

In the Cascades physiographic province, the Mount Shasta Mudflow RNA (Keeler-Wolf 1984) was established to preserve a soil-vegetation chronosequence on volcanic glacial outwash mudflows. The majority of the area is dominated by several forms of ponderosa pine vegetation. These vary in age, size and density as a result of mudflow depth and fire history. The majority of the stands are even-aged and dominated by trees under 100 years old. The oldest forests are multi-aged and range from an eastside type (Holland code 84220) with understory dominated by *Purshia tridentata* to a westside type transitional with Sierra Nevada mixed conifer forest (Holland 84230) with *Arctostaphylos patula, Ceanothus velutinus, Chrysolepis sempervirens,* and other mountain chaparral species in the understory. Elevations and annual precipitation are somewhat higher than at Graham Pinery and California black oak and lower elevation chaparral types are not a significant part of the area.

The Peavine Point RNA is in the Northern Sierra Nevada physiographic province in Eldorado National Forest. It has a larger elevational gradient and steeper slopes than the GPRNA. Westside ponderosa pine forest is the most extensive type in the area, occupying mostly s-facing exposures. North-facing slopes have Douglas-fir-dominated forest. There is well-developed riparian vegetation along the S. Fork American River. The understory of the ponderosa pine forest is dominated by *Chamaebatia foliolosa,* a shrub not present at GPRNA or Shasta Mudflow RNA. California black oak is a major

understory species, although there is no discussion of black oak-dominated stands (Taylor and Randall 1977), so prevalent at GPRNA. Ground fire has been a regular influence in the area with most mature trees scarred. The forest is relatively open with total stem density averaging 239/ha (similar to GPRNA, see vegetation section) and the average size of ponderosa pine stems is relativley large (ca. 23 inches, 59 cm dbh, vs. ca. 20 inches, 51 cm at GPRNA). Basal area averages almost two times as great (64 m^2/ha vs. 33 m^2/ha) as at GPRNA.

The third site is Bishop Creek RNA on the Sierra National Forest just west of the Wawona Road in Yosemite National Park, in the Southern Sierra Nevada physiographic province. About half of this area is covered with low elevation montane coniferous forest with ponderosa pine as a major component. This forest is divided into three phases by Talley (1981). These are: 1) open ponderosa pine-California black oak with a dense *Chamaebatia foliolosa* understory, 2) closed ponderosa pine-California black oak forest with sparse understory, and 3) riparian conifer forest dominated by incense-cedar (*Calocedrus decurrens*). The first type appears analogous to the major ponderosa pine type at Peavine Point, the second phase has a denser canopy and subcanopy of ponderosa pine and California black oak with several woody understory species absent from the first phase. The riparian phase is dominated by incense-cedar with white fir, Pacific dogwood (*Cornus nuttallii*) and white alder (*Alnus rhombifolia*) in the mesic to hydric sites adjacent to creeks. Ponderosa pine and California black oak are limited to large mature individuals.

Compared to all three of these sites, Graham Pinery has the least topographic diversity, the lowest average basal area and and the lowest mean elevation. It is the only site that has extensive California black oak vegetation (see next section). It is also the only area that has had a fire since the ecological survey was conducted. Compared to the other site in the Cascades province, GPRNA has a distinctly more west-side character with absence of *Purshia tridentata, Haplopappus bloomeri,* and other interior-montane species. It is more characteristic of the true westside phase of ponderosa pine forest.

Although under similar climatic regime the ponderosa pine element at GPRNA will again represent a mature example of the type, for the present, it would be wise to select additional intact ponderosa pine stands to include in a pacific ponderosa pine RNA for the Cascades province of Region 5 (see recommendations).

California Black Oak:

This vegetation type covers more area than ponderosa pine at GPRNA. It is well represented in nine candidate and established RNAs throughout the state (Keeler-Wolf 1990). However, its only other representation in the Cascades physiographic province is as scattered small stands at the Indian Creek RNA. At Graham Pinery, the extensive stands with variable structure and understory composition are a far better representation of the black oak series than the stands at Indian Creek.

California black oak resprouts after fire. The above-ground portion of the plant is not fire-resistant

until boles reach large dimensions, resulting in multiple-stemmed plants growing in even-aged stands throughout much of the distribution of the type. There is good indication (McDonald 1980b, Bolsinger 1988) that fire and logging over the past 100 years has increased the coverage of the type in California. California black oak is shade-intolerant and despite abundant seedling production (up to 8800/ha, Rundel et al. 1977), will not survive beyond seedlings unless the seed bed has been cleared unnaturally or by fire (McDonald et al. 1983b). Resprouting following fire is very rapid, averaging 20 ft. (6 m) in the first 10 years and far surpasses the rate of seedling growth (McDonald et al. 1983b). Resprouting of long-persisting stands appears to be the primary method of stand mainanence, while seedling on the periphery of these stands by survivor trees following a fire or other disturbance may increase stand area.

At GPRNA California black oak vegtetation covers large areas on the periphery of the ponderosa pine-dominated core. It also is extensive on the northerly facing slopes to the south of the RNA (photo 5). Prior to the August 1990 fire, California black oak occurred as two major types in the GPRNA. By far the most extensive of these was the multiple-stemmed fire disclimax type. Dominated by even-aged stems dating back to the 1931 fire, the largest area in and adjacent to the pinery had closed stands with an interlocking canopy ca 45 ft. (14 m) tall and stems averaging ca. 7 inches (18 cm) dbh (photo 6). These pure stands had a variable understory depending upon slope exposure and rockiness of the soil (see vegetation section). Compared to the ca. 50 year old stands of California black oak at Big Grizzly Mountain c RNA (Keeler-Wolf 1987), the 59 year old stems at GPRNA averaged smaller and fewer resprouts per clump. This suggests that rainfall and perhaps soil fertility and depth was not as great at GPRNA as at Big Grizzly Mountain.

The other less extensive phase was dominated by older single-stemed individuals up to ca. 300 years old. These older stands were scattered within the core area of the pinery and clearly had not been significantly affected by the 1931 fire (photo 7). They tended to occur interspersed with stands of ponderosa pine, often on the periphery of small open areas dominated by shrub species such as *Rhamnus rubra* or *Ceanothus lemmonii.* When these stands were re-visited three months following the fire, several of the older stems were already resprouting from the upper boles, suggesting that again, these larger stems would endure the effects of the fire.

Biogeographic Significance:

As might be expected from its mixture of montane coniferous and upper foothill vegetation types, the GPRNA contains a melange of species characteristic of both foothill and montane habitats. These include not only plants, but animal species as well. Among the plants characteristic of montane elevations include *Arctostaphylos patula, Carex multicaulis, Castilleja applegatei, Chrysothamnus nauseosus, Cornus nuttallii, Erigeron inornatus, Hieracium albiflorum, Lithospermum californicum, Lupinus onustus, Osmorhiza chilensis, Polygala cornuta, Prunus emarginata, Rhamnus rubra* ssp. *obtusissima, Ribes roezlii,* and *Viola lobata.* Most of these species are associated with the interior

portion of the pinery with ponderosa pine stands. Low elevation foothill species of plants include; *Aesculus californicus, Arctostaphylos viscida, Arenaria douglasii, Balsamorhiza macrolepis, Calochortus luteus, Ceanothus cuneatus, Cercis occidentalis, Chaenactis glabriscula* var. *megacephala, Chorizanthe polygonoides, Eremocarpus setigerus, Filago californica, Fraxinus dipetala, Galium nuttallii, Lupinus vallicola, Pinus sabiniana, Ptelea crenulata, Rhamnus illicifolia, Rigiopappus leptocladus, Salvia sonomensis, Sidalcea hartwegii, Trifolium tridentatum,* and *Tunica prolifera.* These species are typical associates of the chaparral stands fringing the pinery.

Animals detected at GPRNA characteristic of the montane zones in this part of California include sagebrush lizard, mountain quail, white-headed woodpecker, olive-sided flycatcher, red-breasted nuthatch, Steller's jay, solitary vireo, Nashville warbler, MacGillivray's warbler, western tanager, dark-eyed junco, and purple finch. Again, as with the plants, most of these species are characteristic of the ponderosa pine stands at GPRNA. Foothill species characteristic of the chaparral and black oak vegetation include; striped racer, California quail, mourning dove, black-chinnned hummingbird, ash-throated flycatcher, blue-gray gnatcatcher, wrentit, Bewick's wren, scrub, jay, Hutton's vireo, orange-crowned warbler, rufous-sided towhee, and Lawrence's goldfinch.

In addition to the mixing of species of low and higher elevations, the GPRNA is also situated at the northern extreme of the range of a group of plants typical of the foothills of the Sierra Nevada. According to Munz (1968), the following species noted at GPRNA reach their northern limits in Butte County, inferring that their occurrence here is a small extension of their known ranges (those individuals with an "*" are also known from Indian Creek RNA, Tehama County, ca. 9 miles (14.5 km) north of GPRNA, Keeler-Wolf 1986, 1990b). *Clarkia arcuata* , Galium nuttallii*, Lepechinia calycosa*, Lilium humboldtii, Penstemon heterophyllus* ssp. *purdyi, Polygonum bolanderi*, Tauschia hartwegii,* and *Tauschia kelloggii.*

Rare Plants:

Two species considered members of list 3 (plants about which more information is required) of the California Native Plant Society's list of rare and endangered vascular plants (Smith and Berg 1988) occur at GPRNA. The first is *Calystegia atriplicifolia* ssp. *buttensis.* This is a recently described taxon (Brummitt 1980) . This short non-twining plant was commonly encountered in the core area of the pinery growing in the sunny openings beneath the open canopy of pines and scattered California black oaks. In Munz (1968) this species keys easily to *Calystegia nyctagineus* (a synonym for *C. atriplicifolius*). According to Smith and Berg (1988) this plant has only been collected in the Paradise East 7.5 minute quadrangle, about 15-20 miles (24-32 km) se of GPRNA.

The other rare species is *Balsamorhiza macrolepis* (photo 8). This species was found occasionally in the sunny openings of the central pinery. It is apparently characteristic of the foothill grasslands and woodlands of lower elevations and is not listed above 2000 ft. (610 m) elevation in Munz (1968). At

the pinery it was found between 2400 and 2700 ft. (732-823 m) elevation. This species was not encountered as frequently, nor was it as widely distributed as the previous rare species. Neither of these species are listed by the Lassen National Forest as sensitive (Beth Corbin, Forest Botanist, pers. comm. 1991).

Both rare species were not deposited as vouchers, however identifications were based on identification of floral parts. In both cases no ambiguuity was met with during the keying-out process.

PHYSICAL AND CLIMATIC SETTING

The GPRNA lies along the western side of the southern Cascade Range. The entire are is underlain by a series of Tertiary volcanic pyroclastic flows of the Tuscan Formation, stretching for 65 miles (104 km) north-south along the western flanks of the Cascades (MacDonald 1966). The age of the southwestern portion of the Tuscan Formation is believed to be late Pliocene (3.3 m.y.). The virtually level tops of Graham Pinery, Beaver Creek Pinery, Digger Pine Flat, Deer Creek Flat and other remnant peneplains in the region, suggest that prior to the more recent uplift of the Cascades (Pleistocene) and down-cutting of Deer Creek and its tributaries, the entire area in the vicinity of the RNA was a very gradually sloping westerward-dipping plateau. At present the relatively flat tops of these remnant peneplains contrast sharply with the deeply eroded, steep slopes of the canyons, which now cover the majority of the area.

The Graham Pinery forms an elongated strip about 2.5 miles (4.0 km) long and from 0.25 to 0.75 miles (0.4-1.2 km) wide. On its north side are precipitous cliffs and rocky slopes (>50°) which drop about 1000-1300 ft. (305-396 m) in 0.5 miles (0.8 km) or less, to Deer Creek. On the south side, the pinery is bordered by the more gently sloping, less deeply cut valley of the intermittent tributary of Deer Creek known as Wildcat Creek, ranging in depth from 100 to 800 ft. (31-244 m). The summit of the Pinery ranges from ca. 2300 ft. (708 m) on the private land to the west of the RNA to ca. 2810 ft. (857 m) along the eastern margin.

The relatively low elevation of the area places it below the belt of maximum precipitation for the region (in the red fir zone, ca. 6000-7000 ft, (1829-2134 m). However, its northern California position places it in the path of more winter cyclonic stoms than similar elevations further southward along the western side of the Sierra Nevada. Thus, precipitation averages somewhat higher than at similar elevations further south. Although no temperature or precipitation recording stations exist in close proximity to the GPRNA a reasonable approximation of the local climate may be estimated from data in Goodridge (1981), Rantz (1972), and Major (1977).

The nearest long-term recording station for temperature and precipitation with a climate similar to

GPRNA is Red Bluff (temperature and precipitation for 120 years). Red Bluff is approximately 27 miles (43 km) southwest of the RNA at an elevation of 342 ft. (40° 9' N, 122° 15' W). Following is a table presenting the mean monthly precipitation from 1941-1970[2].

Table 1: A thirty year average monthly precipitation record for Red Bluff.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
inches	4.48	3.17	2.51	1.79	0.98	0.47	0.04	0.18	0.31	1.17	3.05	3.91	22.06
mm	113.8	80.5	63.8	45.5	24.9	11.9	1.0	4.5	8.9	29.7	77.5	99.3	560.3

A 20 year average of temperatures (1953-1972) for Red Bluff is presented below[3].

Table 2: Temperature data summary for 20 years at Red Bluff.

	x ann temp	x Jan. low	x Jan. high	x July low	x July high	x ann low	x ann. high
°F	62.7	36.8	53.6	66.2	98.2	24	111
°C	17.0	2.7	12.0	18.8	36.8	-4.4	43.9

Temperatures at GPRNA are likely to average somewhat lower than Red Bluff as a result of the RNA's higher elevations. According to calculations by Major (1977) annual lapse rates over the western side of the southern Cascades east of Red Bluff are ca. -3.4°F/1000 ft. (-0.60°C/100 m). Hence, at about 2800 ft. (853 m) the GPRNA probably has an average annual temperature of about 53° F (11.9° C).

Isohyets in Rantz (1972) suggest the average annual precipitation at GPRNA is between 30 and 40 inches (762-1016 mm). Precipitation is mostly in the form of rain falling between November and April. Snow falls regularly during the coldest months, but rarely accumulates for more than a few days before melting.

During the visit to the area between May 11 and May 16 1990 low temperatures were mild, between 47 and 54° F (8.3-12.2° C) and high temperatures ranged between 72 and 78° F (22.2-25.5° C). The sky was generally cloudless except for scattered cumulus on two days.

[2] data from Goodridge, J.D. 1981. California Rainfall Summary. State of California Department of Water Resources, Sacramento.

[3] data from U.S. Department of Commerce weather bulletins 1953-1972

VEGETATION AND FLORA

The flora of the GPRNA is not particularly diverse. About 140 taxa of vascular plants were collected from the area during the field work for this report. This relativley low diversity has much to do with the lack of any permanent source of water in the area, the low topographic relief, and low habitat diversity.

Vegetation Types:

The vegetation map (Map 3) is based on the Holland (1986) system of terrestrial plant communities. Following is a description of the major plant associations occurring in the GPRNA. The code numbers following the association names are Holland type numbers. Table 3 shows acreages and equivalent habitat classification schemes.

Table 3: Area by cover types for Graham Pinery cRNA with code numbers for Holland (1986), SAF (Eyre 1980), and Kuchler (1966) classifications.

	% total	acres	hectares
HOLLAND TYPES			
Black Oak Forest-Woodland (81340, 71120)	47.9	338	136.8
Westside Ponderosa Pine Forest (84120)	31.6	223	90.3
Canyon Live Oak Forest (81320)	7.0	48	19.4
Shin Oak Brush (37541)	5.0	35	14.2
Buck Brush Chaparral (37810)	3.5	25	10.1
Montane Manzanita Chaparral (37520)	2.6	18	7.3
Mesic North Slope Chaparral (37E00)	2.6	18	7.3
unclassified	0.0	0	0.0
totals	100.0	705	285.3
SAF TYPES			
Pacific ponderosa pine (245)	31.6	223	90.3
California black oak (246)	47.9	338	136.8
Canyon live oak (249)	5.0	35	14.2
unclassified	~~109~~ 15.5	~~44~~ 109	~~17.8~~ ~~44.0~~
totals	100.0	705	285.3
KUCHLER TYPES			
Chaparral (29) 15.5	~~109~~ 15.5	~~44.1~~ 109	44.0
Western ponderosa forest (5)	31.6	223	90.3
California oakwoods (26)	52.9	373	151.0
unclassified	0.0	0	0.0
totals	100.0	705	285.3

Black Oak Forest and Woodland (71120, 81340):

California black oak dominates the largest portion of the RNA, forming an irregular band around the central ponderosa pine-dominated vegetation, as well as smaller islands within it. The largest portion of the black oak cover prior to August 1990 was made up of even-aged resprouts resulting from canopy damage from the 1931 fire. This resprout forest was generally dense with canopy cover averaging between 65 and 70%. Throughout most of the area the canopy height varied between ca. 35 and 50 ft. (10.6-15.4 m) with the average about 45 ft. (13.7 m) The 59± year old stems averaged about 7 inches (17.8 cm) dbh with some as small as 2 inches and as large as 16 inches (5-41 cm).

Beneath the uniform canopy on the virtually level or gently southwest-sloping summit of the pinery was a sparse, mixed understory. The dominants consisted of scattered small shrubs of *Rhamnus rubra, Toxicodendron diversilobum* and *Berberis dictyota,* along with such herbs as *Carex multicaulis, Stipa lemmonii, Galium nuttallii,* and *Tauschia kelloggii.* On more mesic exposures (e.g., gentle northerly slopes) the characteristics of the canopy remained similar, but the understory tended to become dominated by *Toxicodendron diversilobum* with up to 50% cover (photo 9). Other herbs characteristic of more mesic environments such as *Delphinium nudicaule, Erysimum capitatum, Osmorhiza chilensis, Rubus ursinus,* and *Lilium humboldii* also occurred.

Throughout most of the black oak stands on the pinery, there were the occasional monarch oaks. These specimens clearly survived the fire of 1931 without major stem damage, continuing to add to their stem dimensions. Typical survivors were between 20 and 25 inches (51-64 cm) dbh and 50-60 ft. (15-18 m) tall. However, the occasional tree reached huge dimensions. The largest California black oak measured was 41 inches (104 cm) dbh and about 100 ft. (31 m) tall (photo 10). These survivors average a density of ca. 10/ha throughout the main body of the black oak forest.

The black oak stands become shorter and more spindly on the western end of the pinery, near the boundary with private land in the western half of section 4. Here the multi-stemmed sprouts average only 4-6 inches (10-15 cm) dbh and 25-35 ft. (8-11 m) tall. This type of black oak forest integrades with chaparral dominated by *Arctostaphylos viscida* and *Quercus garryana* var. *breweri* with openings dominated by *Salvia sonomensis.* The relatively low elevation, and shallow, rocky soil, combine to create a xeric setting. The narrow plateau in this area also fosters locally hot fires, burning in from the surrounding chaparral, reducing the number of survivor trees, and killing all above ground vegetation.

Vegetation sampling was conducted in a modal stand of black oak in the sw 1/4 section 34. Ten 10 x 10 m plots were laid out along a transect at 50 m intervals. The results are summarized in tables 4 and 5.

Table 4: Tree (> 2 m tall) density, frequency and basal area cover on ten 10 x 10 m plots in gently sw-sloping, multiple-stemmed black oak forest, Graham Pinery candidate RNA.

species	density /ha	frequency	basal area m^2/ha
black oak	1230	1.00	38.7
ponderosa pine	10	0.10	0.1

Table 5: Frequency and average percent cover of herbs and shrubs on ten 10 x 10 m plots in multiple-stemed black oak forest at Graham Pinery candidate RNA.

species	frequency	mean cover (%)
Rhamnus rubra obtussisima	1.00	5.6
Toxicodendron diversilobum	0.70	1.6
Stipa lemmonii	0.80	0.6
Carex multicaulis	0.60	0.2
Berberis dictyota	0.70	0.1
Ceanothus lemmonii	0.10	0.1
Galium nuttallii	0.70	tr.
Tauschia kelloggii	0.40	tr.
Dichelostemma multiflora	0.30	tr.
Polygala cornuta	0.30	tr.
Agoseris retrorsa	0.20	tr.
Sanicula bipinnitidifida flava	0.20	tr.
Solidago californica	0.20	tr.
Hieracium albiflorum	0.10	tr.
total mean cover		8.2

In the sampled stand the majority of individual black oaks had multiple stems. Only about 2% of the individuals had surviving stems dating back to before the 1931 fire. The average number of stems per tree was 2.3 (range 1-7).

There was some variation in the growth rate of the resprout stems. The average dbh of the resprout stems in the sample was about 7.5 inches (19 cm). However these 59± year old stems ranged from 2 to 16 inches (5-41 cm) dbh. In many cases the number of resprout stems had diminished from the original number sprouting after the fire. Fifty percent stem loss was typical among the resprout individuals. No clear relationship was evident between environmental causes and stem loss.

Black oak seedlings were few, averaging 440/ha, and saplings were non-existant in the sample. The amount of duff and shading are likely to be too great to allow for successful reproduction.

Old growth black oak: The second type of black oak-dominated vegetation at GPRNA is composed of trees with stems older than the 1931 fire. This type, represented by small open stands of large black oaks, occurred within the main body of the ponderosa pine dominated stands in the core of the pinery. The largest stand of this type covered about 3 acres (1.2 ha). Several other smaller stands from 0.25-1 acre (0.1-0.4 ha) in size occurred in the area. These stands averaged about 50% crown cover and were dominated by single-stemmed oaks ranging from 13 to 32 inches (33-81 cm) dbh (mean ca. 18 inches, 46 cm). The average canopy height of these stands was between 50 and 60 ft. (15-18 m)

Two 400 m^2 plots were sampled in the largest such stand. The average density for these plots was 238 stems/ha with a basal area cover averaging 38.3 m^2/ha. Saplings and seedlings of black oak were more equitably represented than in the multi-stemmed sample, with seedlings averaging 120/ha and saplings (over 6 inches) 25/ha. Ponderosa pine seedlings also were represented in the sample averaging 25/ha. The more open canopy and sunnier ground layer are likely the main cause of higher recent reproduction than in the resprout stands.

Understory shrubs and herbs covered an average of 7.5%, similar to the multi-stemmed stands. They were represented by a similar group of species with *Vulpia pacifica* and *Keckiella lemmonii*, the only regularly occurring species not sampled in the multi-stemmed stands.

Effects of the 1990 fire: The Campbell fire burned from the southwest into the RNA, consuming much of the above-ground vegetation in the Brewer oak, manzanita, and *Ceanothus cuneatus*-dominated chaparrals on the south slope of the pinery in a hot fire (photo 11). However, almost immediately upon entry into the California black oak stands, the fire lessened in intensity. In most cases the multi-stemmed black oaks suffered crown fire less than 100 m into the main stands on the top of the pinery (photo 12). Throughout the majority of the black oak vegetation, the fire remained on the ground, singeing 2-3 ft, (61-91 cm) of the stems, but not consuming the canopy wood or foliage even in the densest stands (photo 13). The canopy foliage in most of these stands was, however, dessicated and killed. Within the pinery, the fire left several small areas unburned. These areas, typically, were without a canopy of either black oak or ponderosa pine, and were dominated by low herbaceous or shrubby growth such as *Ceanothus lemmonii* and *Salvia sonomensis* with much bare ground (photo 14 and 15). The black oak stands adjacent to these openings were not affected as much as most. During a post-fire re-visit November 10, 1990 many of the trees adjacent to the openings had golden foliage, typical of the natural fall color of the species. This suggests that these stems did not die and will continue to grow.

In the largest single-stemmed stand of black oak in the core area, foliage was typically scortched to a light brown, but scattered new green leaves were sprouting well up into the canopy of the oaks,

suggesting that the heat of the fire had killed the leaves, but was not sufficient to kill the cambium layer of these large-boled, thick-barked trees.

The majority of the multiple stemed black oaks are likely to loose their 59 year old stems and begin resprouting quickly from the base. There is no indication that the fire of 1990 was any less intense than the fire of 1931, which did initiate broad-scale resprouting. Despite the lack of crown damage from the recent fire, the singeing of the thin-barked lower stems was apparently sufficient to kill the cambium layer. Prior to the 1990 fire, evidence of long-dead, but recently fallen stems, hollowed out basal knot holes, and occasional decomposed snags suggests that the dead stems from the 1931 fire often remained attached to the rootcrowns for many years.

Ponderosa Pine (84210):

Prior to 1990 the core area of the pinery was vegetated with a matrix of ponderosa pine, small shrub-dominated openings, and multi-stemmed and single stemmed California black oak. Although ponderosa pine clearly dominated the core area (in basal cover and, less clearly, numerically) it occurred in open, more-or-less discrete stands, and did not form an extensive un-broken forest. Typically, the stands were dominated by large, old individuals, with scattered clumps of younger trees (59-100 years) and more recent reproduction on the periphery of these stands. The shrubby openings in this core area were not dominated by chaparral shrubs typical of the surrounding breccia scablands and steep slopes on the edge of the pinery. They, instead, were dominated by species typical of the coniferous forest belt in the southern Cascades. These small shrubby openings (none larger than ca. 1 ha) were intimately related to the stands of ponderosa pines (photo 16). The same species of shrubs tended to dominate the understory beneath the open stands of pines. Hence, these openings will be considered as a part of the ponderosa pine vegetation in this report. However, it must be remembered that on a micro-scale, the openings were structurally distinct from the denser groves of pines they were associated with.

As of May 1990 there were several age groups of ponderosa pines. The youngest were seedlings and saplings. These rare individuals recently germinated in the small openings adjacent to, or within, open stands of larger trees. Within the sample, the density of saplings (>6 in., <6 ft. tall) was 3/ha. Seedling density in the sampled area was 15/ha. Clearly, these age groups were not reproducing well. Given the high mortality rates for most young pines, they would not have been expected to restock the forest under static environmental conditions.

Pole size pines however, were well represented. About 40% of all trees samped were from 1 to 10 inches (2.5-25.4 cm) dbh. The majority of these trees germinated in the past 60 years. Many occurred in dense stands adjacent to larger and older pines, and were probably the result of the first good cone crop following the 1931 fire. Despite the large number of pole-size trees, there were also a number of larger young trees also dating back to the 1931 fire. Under uncrowded conditions in relativley deep soil, 50-59 year old ponderosa pines attained diameters of between 22 and 24 inches (55.9-61.0 cm) dbh and heights of ca. 80 ft. (24.4 m). Approximately 10% of the total ponderosa pines sampled were represented by these young, fast growing trees from 11 to 24 inches (27.9-61.0 cm) dbh.

The other 50% of the ponderosa pines sampled were older than 59 years. Within this group there were also several age groups represented. The youngest of these were perhaps 50-60 years old when the 1931 fire occurred, and were (in 1990) between 21 and 30 inches (53-76 cm) dbh. Only a few trees of this age were detected, suggesting that the 1931 fire killed most of the individuals of this age group. A much larger group was represented by trees between 160 and 165 years old. These trees varied in size from 21 to 36 inches (53-91 cm) dbh and were between 100 and 120 ft. (31-37 m) tall. These individuals had only light singeing at the base of the stems, suggesting that when they were ca. 100 years old they experienced the ground fire of 1931, but were not noticeably affected by other earlier fires.

The oldest group of trees living in May 1990 were those between 200 and 400 years. As a rule, they did not exceed the 160-165 year cohort in height, but may have been significantly larger in diameter. The largest living tree was 54 inches (137 cm) dbh and had about a 6 ft. (1.8 m) tall cat-face scar on its southward facing base. Another tree ca. 130 ft. (40 m) tall, 37 inches (94 cm) dbh, and ca. 270 years old was representative of the majority of the large trees. This individual, as with most its age, had only minor fire singeing, with no pronounced cat-face scars.

Several snags and stumps of old ponderosa pines occurred through the main core area. One of these, which was estimated to have been dead for over 30 years had 389 rings at about 8 ft. above the base. Despite the four years of below normal precipitation prior to the May 1990 visit, few ponderosa pines were recently dead. Those that were, tended to be large individuals growing in close proximity to other mature individuals. Bark beetles appeared to be the proximate cause of death.

Vegetation sampling was conducted in the core area in May 1990 along a 1500 m transect with 20 x 20 m plots sampled every 100 m. Tables 6 and 7 present the data.

Table 6: Tree (> 2 m tall) density, frequency, and basal area cover on fifteen 20 x 20 m plots in ponderosa pine forest, Graham Pinery candidate RNA.

species	density /ha	frequency	basal area m^2/ha
ponderosa pine	135	0.93	26.6
black oak	127	0.87	6.1
totals	262	1.80	32.7

Table 7: Frequency and mean percent cover for herbs and shrub on fifteen 20 x 20 m plots in ponderosa pine forest, Graham Pinery candidate RNA.

species	frequency	mean cover (%)
Rhamnus rubra obtusissima	1.00	10.93
Ceanothus lemmonii	0.80	7.86
Stipa lemmonii	0.87	4.07
Berberis dictyota	0.73	2.13
Solidago californica	0.67	1.73
Toxicodendron diversilobum	0.86	1.40
Galium nuttallii	1.00	1.27
Helianthella californica nevadensis	0.33	0.40
Polygala cornuta	0.73	0.27
Tauschia kelloggii	0.73	0.06
Ceanothus prostratus	0.46	0.06
Achillea millefolium	0.26	0.06
Carex multicaulis	0.26	0.06
Clarkia rhomboidea	0.13	0.06
Keckiella lemmonii	0.13	0.06
Penstemon heterophyllus purdyi	0.13	0.06
Horkelia tridentata	0.06	0.06
Phoradendron villosum	0.06	0.06
Dichelostemma multiflora	0.73	tr.
Sanicula bipinnitidifida flava	0.67	tr.
Agoseris retrorsa	0.47	tr.
Erigeron inornatus	0.40	tr.
Vulpia pacifica	0.40	tr.
Chlorogalum pomeridianum	0.33	tr.
Calystegia atriplicifolia buttensis	0.26	tr.
Monardella villosa	0.26	tr.
Viola purpurea	0.26	tr.
Arctostaphylos viscida	0.20	tr.
Graminae sp.	0.13	tr.
Lithospermum californicum	0.13	tr.
Microseris lindleyi	0.13	tr.
Viola lobata	0.13	tr.
Vulpia megalura	0.13	tr.
Daucus pusillus	0.06	tr.
Balsamorhiza macrolepis	0.06	tr.
Calochortus monophyllus	0.06	tr.
Calystegia sp.	0.06	tr.
Apocynum pumilum	0.06	tr.
Asclepias cordifolia	0.06	tr.
Bromus rubens	0.06	tr.
Cryptantha sp.	0.06	tr.
Frasera albicaulis nitida	0.06	tr.
Hieracium albiflorum	0.06	tr.
Lupinus albicaulis	0.06	tr.
Orobanche fasciculata	0.06	tr.
Rigiopappus leptocladus	0.06	tr.
total mean cover		30.60

Although ponderosa pine and black oak are in near equal density in the sample, ponderosa pine covers over 4 times the basal area of black oak. Despite the relatively high percentage of single-stemmed black oaks in the sample (46%), a number of these stems are relatively small and contribute little to the basal area cover. The largest black oak in the sample was 32 inches (81 cm) dbh, but the average size of the stems was about 10 inches (25 cm) dbh. This brings up an important point: although the core area of the pinery typically sustains light surface fires, damage to many of the core's black oak stems did occur in 1931. The number of stems per individual averaged 1.6 in this 6000 m^2 sample. Hence, the stem resprout number is lower than the surrounding predominantly resprout forest, but resprouts of similar dimensions to the extensive surrounding black oak forest are common in the inner core area.

The understory of the open ponderosa pine stands has a similar composition to the black oak stands. However, it is enriched in species number (46 species encountered on 6000 m^2) and it is also represented by higher cover of several species. Four species comprise 70% of the 31% mean cover value for the plots. These are *Rhamnus rubra, Ceanothus lemmonii, Stipa lemmonii,* and *Berberis dictyota.* Compared to the same species in the typical multi-stemmed black oak forest, both *Rhamnus* and *Ceanothus* are taller and more lush, probably as a result of the sunnier exposures and perhaps a locally deeper soil.

1990 and previous fire effects: The high number of apparently dead ponderosa pines of all age groups was a surprizing outcome of the August 1990 fire. Particularly surprizing was the death of a number of large, thick-barked trees, apparently healthy in the spring of 1990. The hypothesized causes of death and damage have already been discussed (see background and justifications).

In general, it appeared that the pines on the southern side of the area survived less well than those of the northern side. This may be the result of the hot fire entering the area from the south, but also may be related to the more scattered occurrence of individuals adjacent to low-fuel openings on the northern side. The survival of similar aged black oak (as indicated by upper stem resprouts three months after the fire), yet the apparent death of pines in the same area suggests that the pines had been more severely moisture-stressed than the black oaks.

Over half of the mature pines had dead foliage to the top of the crowns (photos 17, 18). It is assumed that these trees will not resprout new needle tufts. However, this may not be necessarily the case for some individuals (P. McDonald, PSW Redding, pers. comm, May 1991). A follow-up visit to the area to search for resprouting apical tufts would be valuable.

In May 1990 several large, ancient pine snags were located within areas then dominated by multi-stemmed black oak (photo 19). These were estimated as dying about 50-60 years ago and were perhaps killed by the fire of 1931. The presence of these large pines in an area not presently dominated by ponderosa pine, suggests that the extent of ponderosa pine was once greater than it was

in May 1990.

Clearly, relatively high fire frequency is more condusive to ponderosa pine proliferation than it is to black oak. According to Husari (1981) the acreage of black oak on the Lassen N.F. has increased substantially as a result of fire supression. It seems likely that prior to initiation of fire suppression policies ca. 100 years ago, fire frequencies on Graham Pinery were similar to what is normally the case for the surrounding chaparral (about 1 every 15-20 years, Husari op cit.). At this rate, few black oak seedlings could have colonized the pinery without being killed in the next ground fire. A number of single-stemmed, but small black oak encountered in the core of the pinery were typically young individuals, germinated since the 1931 fire, further supporting the hypothesis that the incursion of black oak into the pinery is relatively recent .

Chaparral (37000):
The chaparral at GPRNA may be divided into several forms, dominated by different sets of species. These include Brewer oak, buckbrush (*Ceanothus cuneatus*)/Gray pine, green-leaf manzanita (*Arctostaphylos patula*), and mixed north slope chaparrals. Because such small areas of these different types occur within the RNA all will be treated under one main heading with the individual entities discussed as sub-types.

Brewer oak (37541): This type dominates large areas immediately adjacent to the multi-stemmed stands of California black oak. It was the most extensive form of chaparral in the RNA prior to the 1990 fire. The species forms resprout thickets from 6 to 10 ft. (1.8-3.1 m) tall and dominates in slightly rockier more exposed sites than black oak. The spindly stems averaged between 1 and 2 inches in basal diameter. Thickets were most common on both the north and south edges of the pinery where slopes ranged up to 30°. Occasional stands occurred on the main plateau adjacent to buckbrush and greenleaf manzanita stands. As a result of the fire, Brewer oak stands were burned, typically with the principal above ground stems charred, but still standing. Basal resprouting was vigorous in most stands. Only three months after the fire new sprouts were as much as 18 inches (46 cm) long (photo 20). Prior to the fire, the understory of such stands included a sparse mixture of herbs and low shrubs such as *Cynoglossum grande, Fritillaria* sp., *Bromus carinatus, Lonicera interrupta, Lepechinia calycosa,* and *Lilium humboldtii.*

Greenleaf Manzanita (37520): This burl-forming species is typical of the extensive brushfields of the mid-montane zone in much of California. At GPRNA it occurs at relatively low elevations, largely on the edges of the pinery. It is not common in the surrounding terrain. The most extensive stands of manzanita occur on the west and north sides of the RNA immediately adjacent to the steep escarpments. These stands had a variable physiognomy following the 1990 fire with some on the north side barely burning (some above ground foliage unaffected), while stands on the west side subjected to a hot fire destroying much above ground vegetation (only main stems remaining). Three months after the fire, scattered short (<3 in., 8 cm) resprouts were seen in the heavily burned stands. Prior to the fire the understory of this phase was typically very sparse, but scattered rocky openings

frequently had mats of *Salvia sonomensis.*

Buck brush/Gray pine (37810, 71322): Prior to the 1990 fire, *Ceanothus cuneatus* was a dominant chaparral species on much of the shallow rocky scabland soil to the east of the pinery. It frequently associated with Digger pine and formed a matrix with a very sparse, herb-dominated vegetation on the extremely rocky exposures of mudflow breccia. It appeared to be the most xerophytic of the chaparrals, ocurring on the shallowest soils in the most highly insolated situations. In the RNA only one small area along the eastern side was dominated by this type. As a result of the scattered, largely bare patches, fire was spotty in the type. However, when affected, the buckbrush stands appeared to be the most completely consumed of all the local chaparrals, frequently with little but ash, indicating the former presence of shrubs.

Most of the scattered Gray pines were relatively young (<50 years) and were no more than ca. 35 ft. (10.7 m). tall. Occasional shrubby California juniper (*Juniperus californica*) occurred in rocky, open areas along with scattered shrubs of *Arctostaphylos viscida, Eriodictyon californica,* and *Chrysothamnus nauseosus.* The herb-dominated openings had a sparse, though relatively diverse mixture of species including; *Sidalcea hartwegii, Lotus humistratus, Allium amplectens, Calochortus luteus, Calycadenia truncata, Bromus rubens, Centaurea solstitalis, Arenaria douglasii, Chaenactis glabriscula, Chorizanthe polygonoides, Eremocarpus setigerus, Penstemon azureus, Filago californica, Navarretia filicaulis,* and *Lessengia nemaclada.*

Buckbrush is an obligate reseeder with seed banks in the soil the principal sources of recolonization. No seedlings were observed in November 1990, probably because of little rainfall up until that time.

An opening of ca. 5 acres (2 ha) in the NW 1/4 sec. 34 atop the pinery was co-dominated by *Ceanothus lemmonii* and buckbrush in May 1990 (see photo 14). This area also had much open rocky ground with scattered mats of *Salvia sonomensis.* It was vegetationally transitional between the buckbrush chaparral and the small openings within the interior of the pinery (see ponderosa pine forest discussion). As a result of the low fuel load and the leeward location of this site with respect to the point of entry for the 1990 fire, this entire opening remained largely unaffected.

Mesic North Slope Chaparral (37E00): A small portion of the chaparral on and adjacent to the northern escarpment falls under this category. There are no clear dominants. *Cercocarpus betuloides, Aesculus californica, Ptelea crenulata, Fraxinus dipetala, Arctostaphylos patula, Cercis occidentalis, Lepechinia calycosa,* shrubby canyon live oak (*Quercus chrysolepis*), California bay (*Umbellularia californica*), and Brewer oak are all regularly occurring shrubs. The pre-1990 fire height of this type was 8-12 ft. (2.4-3.7 m), averaging taller than other chaparrals. This type was not re-visited following the fire. It was transitional to the more extensive canyon live oak forest of the steep northerly-facing escarpments (see next).

Canyon Live Oak Forest (81320):
This vegetation type dominates the steep northerly-facing slopes below the pinery. Small stands of

this type also occurred in places along the southern boundary adjacent to the trace of Wildcat Creek. The fringes of this community just enter into the boundaries as they are drawn now along the 2400 ft. contour. This is the most mesophilic community in the area, dominated, prior to the 1990 fire, by largely multi-stemmed canyon live oak up to 40 ft. (12 m) tall and 12 inches (31 cm) dbh. On the northern escarpment this was typically a closed canopy forest with 60-80% crown cover. California bay was a frequent sub-dominant (also multi-stemmed). The understory included such mesophiles as *Philadelphus lewisii, Torreya californica, Adiantum jordanii, Ceanothus integerrimus, Cynoglossum grande, Dryopteris arguta, Erysimum capitatum, Galium aparine, Heuchera micrantha, Ribes roezlii, Trientalis latifolia,* and *Lomatium californicum.*

Despite often somewhat sheltered locations along the rocky creek bed, or at the northerly base of rock outcrops, the canyon live oak forest along the southern boundary of the area was largely consumed by the fire. This fact further underscores the intensity of the 1990 fire as it entered the southern side of the RNA.

FAUNA

Appendix 2 lists all vertebrates detected during my visits to the GPRNA. The list includes 55 species. The mixture of montane and foothill species present at the pinery has been discussed (see justifications). The Tehama deer herd passes through the area from summer to wintering grounds and also apparently breeds in the area (Carol Molitoris, Range Conservationist, Almanor R.D. , Lassen N.F.). Several rutting grounds were detected in the black oak stands. Numerous bedding sites and about 6 individual deer were sighted on the pinery during my spring visit. Black bear, coyote, gray fox, and possibly mountain lion sign were also detected during May 1990. A small feral horse herd (the Brushy Mountain herd) is also known from the area, and scattered horse droppings throughout the pinery may have been from these wild animals. The effects of deer browsing upon *Ceanothus lemmonii* and *Rhamnus rubra* were pronounced in many areas on the pinery, with the *Ceanothus* particularly heavily pruned.

A breeding bird census was sampled along an approximately 2 km strip 100 m wide (20 ha). It was run through the center of the pinery in the ponderosa pine-dominated vegetation May 16, 1990. The census began at 6:33 and ended at 7:51 AM. (1 hr.:18 minutes). Table 8 presents the results.

The densities of all species were relatively low with no single species attaining densities of 1/ha, and total densities of the 24 tallied species averaging only 5/ha. The three most abundant species included a largely terrestrial and understory omnivore (rufous-sided towhee), a largely arboreal omnivore (western tanager), and a relatively non-specialized arboreal insectivore (black-throated gray warbler). The warbler and the towhee are regionally most abundant in the foothill zones of California, while the tanager is most common in the lower montane zones.

Table 8: Density of birds detected on a 100 x 2000 m strip census run in ponderosa pine vegetation May 16, 1990, Graham Pinery candidate RNA

species	density/20 ha	density/ha
Rufous-sided towhee	14	0.70
Western tanager	12	0.60
Black throated gray warbler	10	0.50
Black-headed grosbeak	8	0.40
Solitary vireo	8	0.40
Mountain quail	7	0.35
Purple finch	7	0.35
Acorn woodpecker	5	0.25
Brown-headed cowbird	4	0.20
Lesser goldfinch	3	0.15
American robin	3	0.15
Red-breasted nuthatch	3	0.15
White-breasted nuthatch	3	0.15
Violet-green swallow	2	0.10
Warbling vireo	2	0.10
Anna's hummingbird	1	0.05
Ash-throated flycatcher	1	0.05
Bewick's wren	1	0.05
Hutton's vireo	1	0.05
Nashville warbler	1	0.05
Northern flicker	1	0.05
Steller's jay	1	0.05
Western flycatcher	1	0.05
Western wood pewee	1	0.05
totals	100	5.00

GEOLOGY

The Tuscan Formation dominates the surface geology of the western Cascades along the entire border of the Great Valley. This 65 mile (105 km) long formation is classified as a polygenic lahar field by Harwood (1990), and is estimated to have once covered (before erosion) about 5,180 km^2. Its source

areas were largely two Pliocene volcanos, no longer extant, the so-called Mt. Maidu and Mt. Yana, named after the Indian tribes in the region.

The source area for the southern portion of the formation, probably including the GPRNA, was Mt. Yana. It was located about 15 miles ENE of Graham Pinery. The southern portion of the Tuscan Formation is older than the northern and was deposited between 3.4 and 2.4 Ma. A large number of individual flows are associated with the formation, most are typical lahars- mixtures of andesitic lava, ash, and tuff. Typical flows are between 20 and 100 ft. (6-31 m) thick. The entire deposit in the vicinity of GPRNA is as much as 1706 ft. (520 m) thick (Harwood, op. cit.). The southern portion of the Tuscan formation is the most deeply dissected, because of its greater age and also because it was uplifted and tilted to the west along a basement fault below the Chico monocline between 2.4 and 1.1 Ma (Harwood op. cit.).

The few level areas in the southern portion of the formation, such as Graham Pinery and Beaver Creek Pinery, are all that is left of the original surface of the flows. It appears that both of these pineries are capped with resistant flows dominated by lava and will erode much more slowly than adjacent areas such as Devil's Den, which are dominated by soft tuff and ash.

SOILS (see map 4)

According to the available information (Gowen 1967), the soils of the main part of GPRNA are all one mapping unit, the Cohasset Gravelly Loam, 10-30% slopes. This is a relativley deep soil found on smooth rounded slopes, averaging 4-6 ft. (1.22-1.83 m) to bedrock. About 10-25% of the soil is made up of angular gravel. Less than 2% of the surface is covered by large rocks. some of which are ca. 2 ft. (61 cm) in diameter. The available water holding capacity is moderate. This is typically a timber producing soil. This soil also includes small areas of Aiken, Guenoc, and Supan soils.

A narrow rim of Guenoc stony loam also occurs around much of the pinery. This soil is mapped by Gowen on the western and southeastern tips of the pinery, largely outside the RNA boundaries, but does appear to be more common within the RNA, than indicated. This soil is on sloping ridges and may occur on largely flat areas. Most areas have large stones (less than 5% total cover) with a variable amount of angular pebbles. Drainage is good, runoff slow-to-medium, and permiability is slow. Available water holding capacity and fertility are low. Locally this soil supports spindly stands of black oak, as well as Brewer oak and manzanita chaparral. This soil is substantially shallower than Cohasset gravelly loam, averaging 20-40 inches (51-102 cm) deep.

Other peripheral soil mapping units are principally rock outcrop, rubbleland (both on the steep escarpments to the n and e of the pinery), and small slivers of Iron Mountain rocky sandy loam 30-50% slopes (on the southern and eastern boundaries.

CULTURAL VALUES

As the name Ishi Wilderness suggests, the lands including the GPRNA were the ancestral home of the Yahi Yana of which Ishi was a member. The abundance of California black oak in the vicinity of the RNA, the most favored acorn species by most California Indians, suggests that the area, despite its xeric nature was at least occasionally used by Indians. The abundance of deer and other game in the black oak forests may also have been attractive to the Yahi hunters.

IMPACTS AND POSSIBLE CONFLICTS

The relatively isolated wilderness location and the lack of water in the RNA minimizes its attractiveness to recreationists. The pinery has been regularly used by a small number of deer hunters for many years. Prior to wilderness status (1984) the area was accessible via a primitive jeep road, which follows the same route as the present trail 2E09 (see map 2) to the edge of the pinery. The relictual jeep road continues onto the pinery and runs through the majority of the ponderosa pine-dominated forest, to the western end. The present condition of the jeep road indicates that it has not been driven upon for many years. It is virtually indistinguishable in many areas, covered with pine and oak duff and overgrown with shrubs and grasses. At the western end of the proposed RNA there is a steel camper shell and a few sheetmetal panels and wooden planks. This is the only well-established campsite on the pinery. There was another campsite on the eastern end of the area, but this was destroyed in the 1990 fire.

During my three visits to the area in May and November 1990 I saw no people in the area. A sign indicating "Graham Pinery", nailed onto a Digger pine at the eastern access point, was apparently destroyed in the fire of 1990. It would be wise not to replace it, assuming the GPRNA will be established.

RECOMMENDATIONS

Pre and Post-fire Values:

As was stated in the introduction, the ponderosa pine element will not be stressed as a target in this report. This is not to say that the value for research on ponderosa pine regeneration is not great at Graham Pinery. However, as a representative of the pacific ponderosa pine type GPRNA, is not currently worthy of RNA status. Even, before the 1990 fire, McDonald et al (1983) strongly suggested that the area not be considered as a ponderosa pine type, but as a mixed California black oak and ponderosa pine type. The relatively low basal area cover of ponderosa pine and the relatively small area it covered prior to the 1990 fire also are undesirable attributes .

Philosophically, the RNA committee and Region 5 should be committed to selecting the best representative of the target element available at the present time. Mature, un-cut westside ponderosa pine forest is a relatively rare resource in California. If the committee selected Graham Pinery as the target for this type in the Cascade Province, then it would effectively be "off the hook" for selecting

any more westside ponderosa pine types in the province, thus, allowing for the possible multiple use (i.e., logging) of the few remaining good stands.

Because it may take 200 years for the Graham Pinery ponderosa pine forest to attain maturity, the opportunity for a great deal of valuable research on mature forest of this type could be lost, if we did not select another site which has good existing mature forest. Because of its lack of topographic diversity and its relatively small potential area for ponderosa pine, GPRNA could be subject again to catastrophic fire. I suggest that the Committee continue its search for the westside ponderosa pine target in the Cascades province, opting for an area with relatively great topographic diversity, which would not be so likely to have major canopy losses if and when a fire or other catastrophic event occurs. The Shasta Mudflow RNA should not remain the sole representative of Pacific ponderosa pine forest in the region because it does vary substantially from the published descriptions of the type and more accurately represents a transitional forest between eastside and westside ponderosa pine types.

I recommend the GPRNA as a candidate for California black oak. The varied stand structure, the knowledge of the past successional history, and the extensiveness of the black oak vegetation all point to its value for research. Additional topographic diversity could be added if the eastern half of section 3 and adjacent portions of the ne 1/4 sect 10 (see map 2) were to be included in the RNA. This area contains additional black oak forest at higher elevations and on moderate northeast-facing slopes (see photo 5). Some of this forest includes ponderosa pine and other conifers and core areas of black oak which did not suffer stem losses following the 1990 fire (photo 22).

Boundaries:

The boundaries of GPRNA correspond closely to the surrounding topography, following the distinct escarpments and including all of the non-privately owned flat plateau area of the pinery (see photos 21 and 22). The boundaries originally drawn in 1981 (Map 5) and those in this report are essentially the same. However, the boundaries in this report were formalized to correspond with contour lines and drainage patterns. Beginning at the private property at the NE corner of sec 5, the boundary continues north, dropping parallel to the slope a short distance to the 2200 ft. (671 m) contour in the NE comer. The boundary follows that contour east and then joggs up slope parallel to the slope to 2400 ft. (732 m) in the ne 1/4 of the sw 1/4 sec 33 and follows the 2400 ft contour east around to the intermittant tributary of Little Pine Creek (SE 1/4 sec 34). At said drainage, the boundary ascends the slope following the drainage channel to the summit of the low ridge in the SW 1/4 SW 1/4 sec 34, dropping parallel with the slope to the bottom of the bed of Wildcat Creek, thence following it westward until the 2400 ft. contour is again intersected. Thence following said contour until it intersects with the edge of the private land along the eastern side of sec. 5.

I recommend the Forest Service looks into enlarging the black oak coverage of the area by including the portions of sec. 3 on the n-facing slope just south of Wildcat Creek. This may require some land exchange as the western portion of sec. 3 is private.

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APPENDIX 1

Vascular Plant List

138 taxa

This list includes all species identified from the field trips associated with this report (May and November 1990). Taxonomy follows Munz (1968) except where noted.

Achillea millefolium; occas. open pp, bo

Adiantum jordanii; occas. n slope on w side of pinery

Aesculus californicus; occas. rocky ne edge of pinery

Agoseris heterophylla; occas. open pp and bo

Agoseris retrorsa; fairly common pp, open bo

Allium amplectens; occas. breccia scabland adj. to pinery

Apocynum pumilum; occas. open pp

Arctostaphylos patula; common on n side of pinery adj to escarpment also on w side in chaparral

Arctostaphylos viscida; fairly common in chap. adj. to pinery and larger openings in pinery

Arenaria douglasii; occas in breccia scabland and larger openings on pinery

Arnica discoidea; occas. n slope under co

Asclepias cordifolia; occas. openings pp

Aspidotus californicus; occasional scabland under rocks

Avena barbata; occas, breccia scabland adj. to pinery

Balsamorhiza deltoidea; uncommon rocky areas on n side of pinery

Balsamorhiza macrolepis; occas. at e end of pinery pp, not listed by Munz above 2000 ft. but up to 2800 ft locally

Berberis dictyota; common open pp , bo

Bromus carinatus; uncommon mesic bo, brewer oak scrub

Bromus diandrus; uncommon on pinery in openings in pp

Bromus mollis; occas. scabland and openings in pp

Bromus rubens; common on breccia scabland adj. to pinery

Calochortus luteus; occas. breccia scabland adj. to pnery

Calochortus monophyllus; occas. pp, bo, open chap on pinery

Calycadenia truncata ssp. *scabrella*; common on breccia scabland adj to pinery

Calystegia atriplicifolia ssp. *buttensis;* this rare taxon is fairly common, widely distributed in open pp and brushy openings dominated by *Rhamnus rubra*. Largely endemic to Butte Co. (Brumlett 1980).

Carex multicaulis; farily common pp, bo, semi-shade

Castilleja applegatei; occas. openings on pinery and rock outcrops on escarpment

Ceanothus cuneatus; common scabland and buckbrush scrub adj. to pinery

Ceanothus integerrimus; uncommon, mostly n slope adj. to pinery

Ceanothus lemmonii; common openings pp

Ceanothus prostratus; occas. on pinery in open pp

Centaurea solstitialis; fairly common, breccia scabland adj. to pinery

Cercis occidentalis; rocky chaparral w side of pinery

Cercocarpus betuloides; n escarpment, adjacent to pinery

Chaenactis glabrisuscula var. *megacephala*; scablands adj. to pinery

Chlorogalum pomeridianum; occas. open pp, chaparral, bo

Chorizanthe polygonoides; common on scablands adj. to pinery

Chrysothamnus nausiosus; uncommon escarpement adj. to pinery

Cirsium pastoris; occas. scabland and escarpment

Clarkia arcuata; scablands adj. to pinery, N limits listed as Butte Co. (Munz).

Clarkia purpurea ssp. *quadrivulnera*; occas. scabland adj. to pinery

Clarkia rhomboidea; fairly common in rockier pp and bo

Clematis lasiantha; occas. chap at edge of pinery

Comandra pallida; occas. mostly edge of escarpment or other rocky areas

Cordylanthus sp.; occas. previous years stalks

Cornus nuttallii; uncommon, mesic n exposures on pinery and ravine on s side

Cryptantha torreyana; occas. scablands adj to pinery

Cynoglossum grande; uncommon mesic bo

Daucus pusillus; occas. openings pp, bo

Delphinium nudicaule; occas. openings in bo

Dichelostemma multiflora; common pp and bo openings

Dryopteris arguta; occas. under co, n escarpment

Eremocarpus setigerus; occas. scablands adj. to pinery

Erigeron inornatus; fairly common pp, bo openings

Eriodictyon californica; common on breccia scablands adj. to pinery

Eriogonum nudum; occas. outcrops ne side of pinery

Eriophyllum lanatum; fairly common on dry scabland and escarpment adj to pinery

Erodium cicutarium; occas. breccia scabland adj. to pinery

Erysimum capitatum; uncommon n slope under co

Euphorbia crenulata; occas. open pp

Filago californica; fairly common on scablands adj. to pinery, had already germinated Nov. 10, 1990 with very little fall rain

Frasera albicaulis ssp. *nitida*; occas. openings on pinery, pp

Fraxinus dipetala; occas. w side in mesic chaparral

Fritillaria eastwoodiae;(?) presumed this sp. (not in flr. in May 1990) uncommon at edges of pinery on n slopes co, bo

Galium aparine; occas. n slope co, chap.

Galium nuttallii; fairly common pp open bo, chap. n limits said to be Butte Co. (Munz)

Gilia capitata; occas. openings in bo, pp

Helianthella californica var. *nevadensis*; common in openings pp

Heuchera micrantha; occas. rocky co n escarpment

Hieracium albiflorum; uncommon, mesic n exposures on pinery, pp

Horkelia tridentata; occas. brushy and sunny openings pp

Juniperus californica; occas escarpment and scabland adj. to pinery

Keckiella lemmonii; fairly common in rockier areas of pinery and on escarpement

Lepechinia calycosa; occasional n slope of pinery, co and Brewer oak, Butte Co thought to be N limits (but found also by this author at Indian Creek RNA in Tehama Co., see Keeler-Wolf 1990)

Lessengia nemaclada; common on scabland adj. to pinery, summer flowering

Lilium humboldtii; occas. mostly in ecotone between chaparral and bo at n edge of pinery. Not cited n of Butte Co. (Munz 1968).

Lithospermum californicum; fairly common openings pp

Lomatium californicum (?); uncommon mesic n slope co, not listed by Munz as known from Cascade foothills.

Lomatium macrocarpum; occas. scabland adj. to pinery

Lonicera interrupta; occas bo, chap. edge of pinery

Lotus humistratus; occas. scablands adj to pinery and larger opeings of pinery (pp)

Lupinus albicaulis; fairly common opeinings pp

Lupinus onustus; occas. mostly pp east side (2600-2800 ft), generally found above 3000 ft.

Lupinus vallicola; occas. on breccia scabland adjcent to pinery

Microseris lindleyi; fairly common in open pp and bo

Monardella villosa; occas openings in pp, scabland and escarpment

Muhlenbergia rigens; occas. along ravine on s side of pinery, resprouts quickly after fire

Navarretia filicaulis; fairly common in scabland e of pinery, not listed by munz above 2700 ft, buth here ca. 2800 ft.

Orobanche fasciculata; common on *Eriodictyon californica,* breccia scabland also uncommon on pinery (there, host unknown)

Osmorhiza chilensis; occas. mesic bo and pp

Penstemon azureus; occas. on rocky escarpment

Penstemon heterophyllus ssp. *purdyi*; occas. open pp, and bo, n limits said to be Butte Co.

Phacelia egena; occas on escarpment ne side of pinery

Philadelphus lewisii; failry common on n escarpment under co

Phoradendron flavescens var. *villosum*; common on black oaks

Phorodendron bolleanum; on *Juniperus californica,* ne escarpment

Pinus ponderosa; common and dominant prior to 1991 fire in core area of pinery

Pinus sabiniana; common in scablands and chap. adj to pinery, occas. on pinery in rockier openings, mostly on s side

Pityrograma triangularis; occas. breccia scabland under rocks

Poa scabrella; w side rocky n slope

Polygala cornuta; common pp, open bo

Polygonum bolanderi; occas on rocky scabland edge of pinery, Butte Co. is thought to be N limits

Prunus emarginata; occas at e end of pinery, open pp

Prunus obcordata; uncommon n escarpment

Pseudotsuga menziesii; rare, one indivual on n slope at edge of pinery

Ptelea crenulata; occas. in n slope chaparral and ecotone w/ co and bo mostly above listed elevation of 2000 ft.

Quercus chrysolepis; common on n slopes and n escarpment occasional small trees on pinery

Quercus garryana var. *breweri*; common forms thickets at edge of pinery mostly on s and e sides

Quercus kelloggii; dominant of bo and intermixed throughout pp

Rhamnus illicifolia; occas. chap adj to pinery

Rhamnus rubra ssp. *obtusissima*; abundant, open pp, bo, and other openings in central pinery

Rhus trilobata; uncommon on n edge of pinery and edge of escarpment, chaparral/bo ecotone

Ribes malvaceum(?); a currant was seen at the base of a steep cliff on n side of pinery, habitat is likely for this species, but it is not reported for Cascade foothills, although known from inner n Coast Range foothills

Ribes roezlii; occas. beneath brewer oak chap.

Rigiopappus leptocladus; occas. in sunny rocky openings in pp and on scabland e of pinery.

Rubus ursinus; uncommon, mesic bo

Salvia sonomensis; common in larger openings on pinery and on scabland adj to pinery

Sanicula bipinnitifida var *flava*; common open bo, pp

Sedum spathulatum; occas., n slope breccia outcrops adj to pinery

Selaginella hansenii; occas. breccia scabland

Senecio aronicoides; uncommon bo, w side of pinery

Sidalcea hartwegii; fairly common on scablands adj. to pinery

Solidago californica; common open pp

Stipa lemmonii; common perennial grass in openings and pp

Streptanthus tortuosus; uncommon rocky openings on w side of pinery

Symphoricarpos mollis; occas bo, pp, co

Tauschia hartwegii; uncommon shade of bo and co near N escarpment, Butte Co thought to be n limit (Munz)

Tauschia kelloggii; fairly common open bo and pp n limits said to be Butte Co.

Torreya californica; occas. on shaded n slopes in co

Toxicodendron diversilobum; common in more mesic stands of bo

Trientalis latifolia; occas n slope co

Trifolium tridentatum; occas. breccia scabland adj. to pinery

Tunica prolifera; fairly common breccia scabland adj. to pinery

Umbellularia californica; fairly common along n escarpment and in rocky areas on s edge of pinery.

Viola lobata; occas. pp beneath shrubs

Viola purpurea; failry common open pp and bo

Vulpia megalura; more common than following species opeinings pp, bo, chap.

Vulpia pacifica; fairly common open pp

APPENDIX 2

Vertebrate List

Graham Pinery Candidate RNA

This list is limited to species observed or otherwise detected during the field visits for this report in May and November 1990.

REPTILES:

Sagebrush lizard; abundant on scabland and in openings on pinery

Northern allegator lizard; fairly common seen regularly several ft. up in Rhamnus rubra bushed, presumed looking for insects attracted to flowers

Southern allegator lizard; uncommon in buckbrush chaparral adj. to pinery

California whiptail; uncommon chaparral and large openings on pinery

Striped racer; seen once on pinery in brushy opening in bo, individual ca. 20 inches long

BIRDS:

Turkey vulture; fairly common overhead

Red-tailed hawk; uncommon overhead

American kestrel; uncommon w end of pinery, pp

California quail; fairly common in chaparral and occasional in bo, pp

Mountain quail; fairly common in pp, bo

Mourning dove; occas. openings in pinery and adj. chaparral

Northern flicker; occasional pp, bo, more common post-fire Nove. 1990

Acorn woodpecker; failry common bo, pp; grainery on w side in old living pp

Hairy woodpecker; fairly common pp, more common post fire November 1990

White-headed woodpecker; seen only in November in fire damaged pp

Anna's hummingbird; occas. throughout

Black-chinned hummingbird; occas, mostly edge of pinery in chaparral

Ash-throated flycatcher; fairly common, chaparral, bo, pp

Western wood pewee; occasional pp, bo

Olive-sided flycatcher; uncommon pp

Western flycatcher; several singing in early morning in pp, May 1990

Violet-green swallow; fairly common along n escarpment

Blue-gray gnatcatcher; common buckbrush chaparral and brewer oak adj. to pinery

Wrentit; failry common buckbrush and Cercocarpus chaparral adj. to pinery

Bushtit; uncommon buckbrush chaparral adj. to pinery

Bewick's wren, occas. chaparral adj to pinery

Red-breasted nuthatch; common pp, very common in november after burn in pp

White-breasted nuthatch; occasional pp, bo

Cedar waxwing; flock of ca. 40 seen over chaparral adj. to pinery May 1990

Steller's jay; fairly common pp
American robin; fairly common pp, bo
Warbling vireo; uncommon bo
Hutton's vireo; fairly common bo, co
Solitary vireo; fairly common pp, bo
Orange-crowned warbler; fialry common chaparral adj to pinery, occas bo in pinery
Nashville warbler; fairly common pp, bo
MacGillivray's warbler; uncommon in chaparral adj. to pinery
Black-throated gray warbler; fairly common pp, co, bo
Brown-headed cowbird; failr common in pp, bo May 1990
Black-headed grosbeak; common in bo and pp
Western tanager; common bo, pp
Rufous-sided towhee; very common on pinery pp, bo in shrubby openings
Dark-eyed junco; occasional pp, bo
purple finch; failry common pp, bo
Lesser goldfinch; common overhead in pp and chaparral, and foraging on Agoseris in pp
Lawrence's goldfinch; seen over chaparral adj to pinery, near n limits for this species

MAMMALS:
Broad-handed mole; occasional in deep soils of pp, cnetral pinery
Botta pocket gopher; diggings common on pinery and even in rocky soil adjacent to it
Black-tailed jackrabbit; common on and adj. to pinery
Coyote; scat seen throughout
Gray fox; scat seen on edge of n escarpment
Black bear; scat and recent prints throughout
Mountain lion: tracks seen on trail ca. 0.25 miles e of Pinery
Mule deer; seen fairly commonly on pinery in May, but evidence of heavy fall and winter occupation (browsed Ceanothus lemmonii, deer rutting areas, bedding sites)
Horse; a feral herd is known from the general area (Brushy Mountain herd). Evidence of horse occupation was seen throughout (not always on established trails) and suggests occasional presence on the pinery

Photo Captions
Graham Pinery Ecological Survey

1. An open stand of mature ponderosa pine between 120 and 130 ft tall and three to four feet dbh near center of pinery, May 1990.

2. The core of pinery November 1990, dead ponderosa pine stand three months following Campbell Fire .

3. Pole-size ponderosa pine created an intense fire, carrying to the canopy in only a few places in the pinery, November 1990.

4. Dense poles of scorched, but not consumed ponderosa pine beneath a killed canopy, November 1990.

5. Extensive California black oak forest on n. facing slopes about 1/4 mile south of summit area of Graham Pinery.

6. Even-aged muliple resprout forest of California black oak, typical of much of the pinery prior to fire of August 1990. Photo taken May 1990.

7. Large, single-stemmed California black oak stand near core of pinery, May 1990.

8. *Balsanorhiza macrolepis*, a rare species found above its listed elevation limits on the open ponderosa pine forest floor in the core area of the pinery.

9. Gently n-facing resprout forest of California black oak with poison-oak dominated understory, May 1990.

10. The largest California black oak found in the area, 100 ft tall and 41 inches dbh.

11. The southern edge of the pinery, November 1990. Fire entered pinery from the south. Although burning in the chaparral intensely (blackened stubs to left), intensity reduced quickly upon entering the black oak stands (right background).

12. Southern edge of pinery showing short distance canopy fire carried into black oak forest.

13. California black oak stand in core area showing only minor singeing on lower trunks, November

1990.

14. Large opening in black oak forest dominated by *Salvia sonomensis* and *Ceanothus cuneatus,* May 1990.

15. Same opening as previous photo taken after the fire, November 1990. Note surviving cover of low shrubs and minor extent of damage in surrounding forest..

16. Small opening in ponderosa pine forest in core of pinery, May 1990. Dominant shrubs are *Rhamnus rubra* and *Ceanothus lemmonii.*

17. Stand of mature ponderosa pine with singed needles to the crowns, November 1990.

18. Large, fire-killed ponderosa pine, despite light damage to surrounding black oaks.

19. Large, long dead pine snags within multi-stemmed California black oak resprout forest, May 1990.

20. Resprouts of Brewer oak on southern edge of pinery . Increment corer is 16 inches long, November 1990.

21. View from the northern escarpment looking down to Deer Creek, May 1990.

22. Distant view of Graham Pinery (middle-ground) showing perched plateau aspect, from the buck-brush chaparral about 1 mile east of RNA.

Photo 1.

Photo 2.

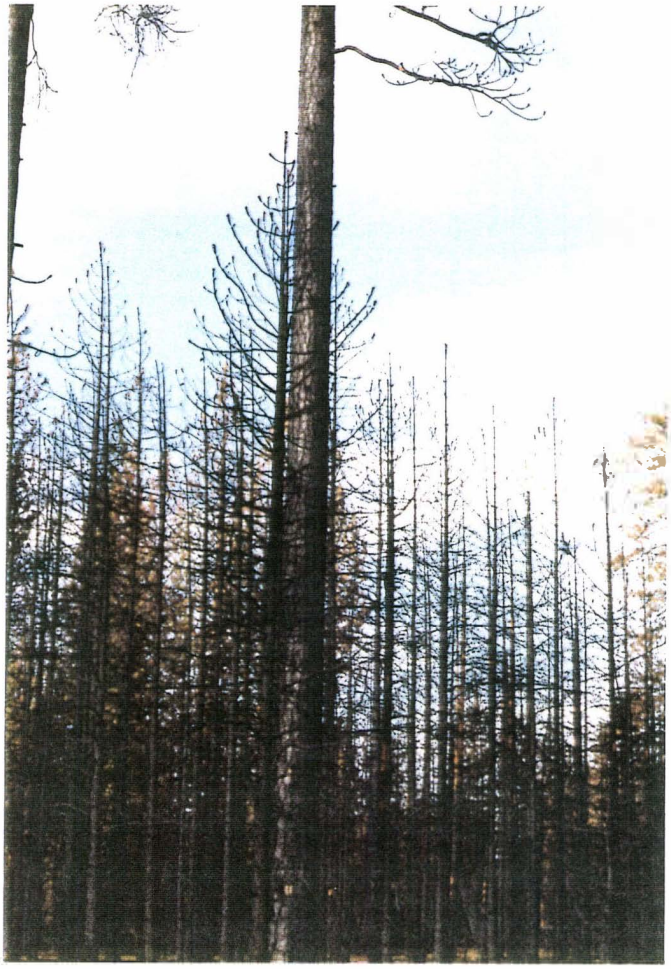


Photo 3.

Photo 4.

Photo 5.

Photo 6.

Photo 7.

Photo 8.

Photo 9.

Photo 10.

Photo 11.

Photo 12.

Photo 13.

Photo 14.

Photo 15.

Photo 16.

Photo 17.

Photo 18.

Photo 19.

Photo 20.

Photo 21.

Photo 22.

MAP 1
LOCATION AND TRANSPORTATION
GRAHAM PINERY CANDIDATE
RESEARCH NATURAL AREA

SCALE: 3/8 INCH=1 MILE

Principal access route.....

RNA.....

Trailhead to RNA.....

Trail route to RNA.....

MAP 2
THE GRAHAM PINERY CANDIDATE
RESEARCH NATURAL AREA

(as proposed in this report)

MAP 3
VEGETATION MAP
GRAHAM PINERY CANDIDATE
RESEARCH NATURAL AREA

Legend

PP.....ponderosa pine forest

BO.....California black oak forest

co.....canyon live oak forest

bb.....buck brush (*Ceanothus cuneatus*) chaparral

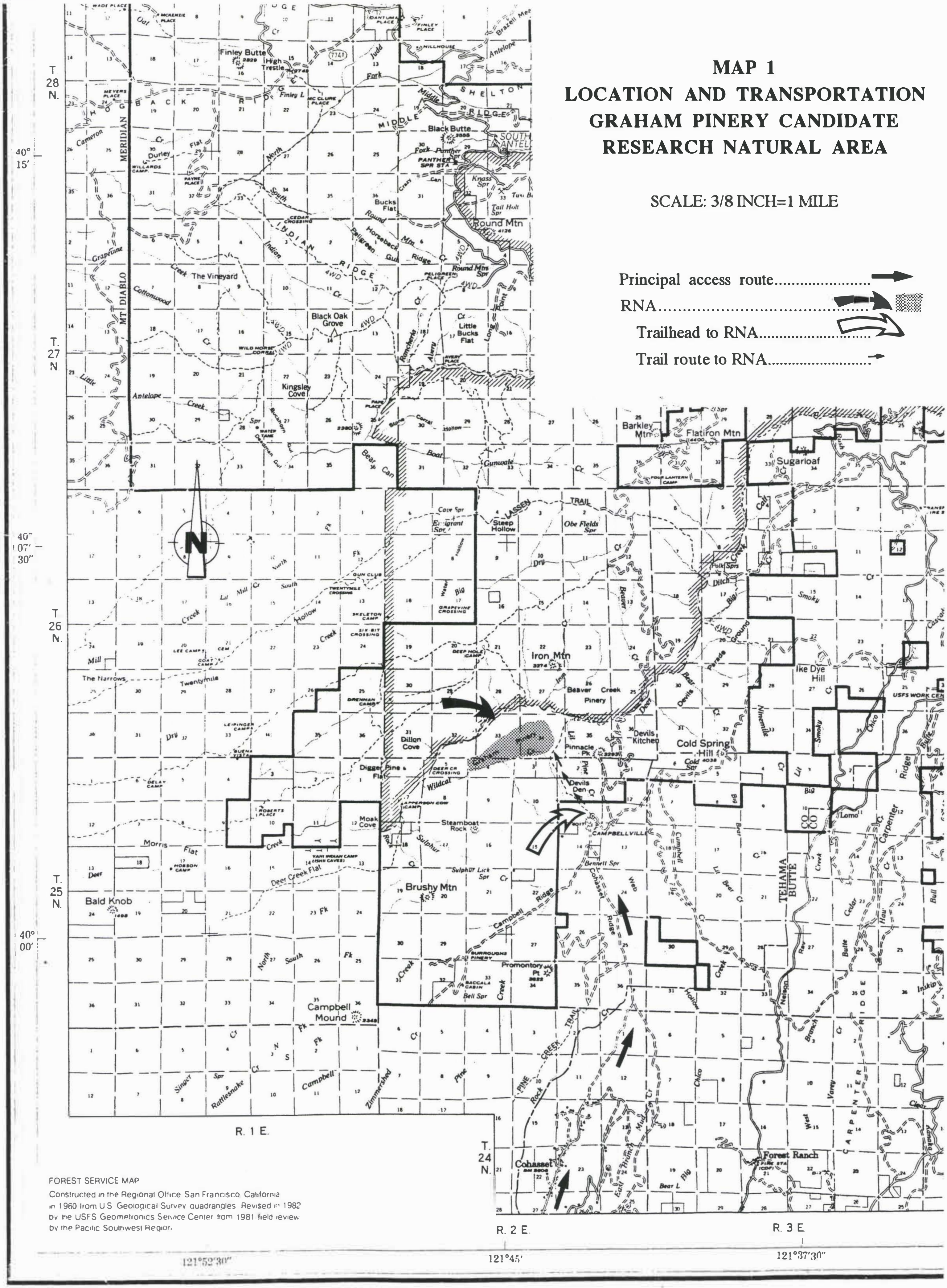
so..... Brewer (shin) oak (*Quercus garryana breweri*) brush

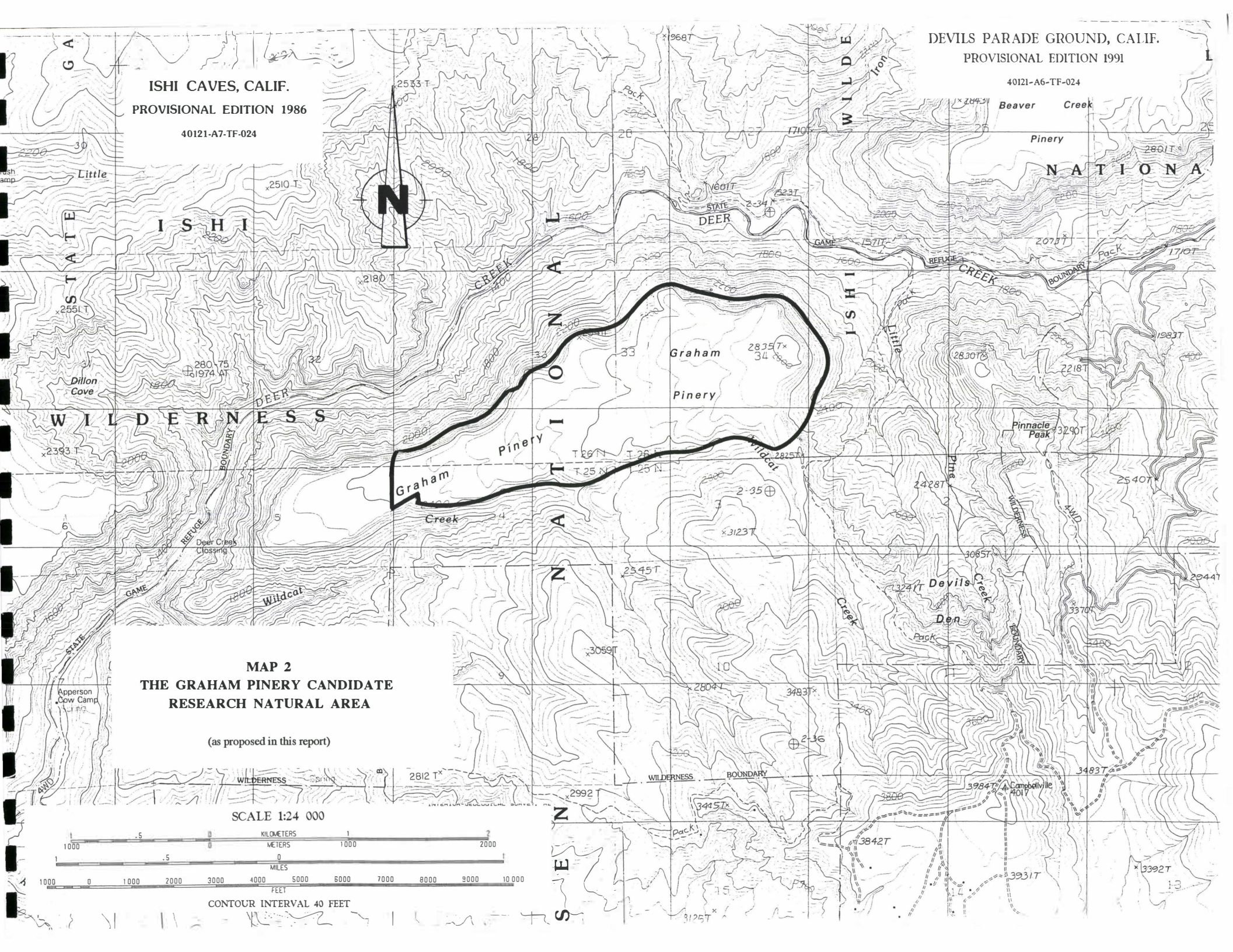
mc.....mesic north slope chaparral

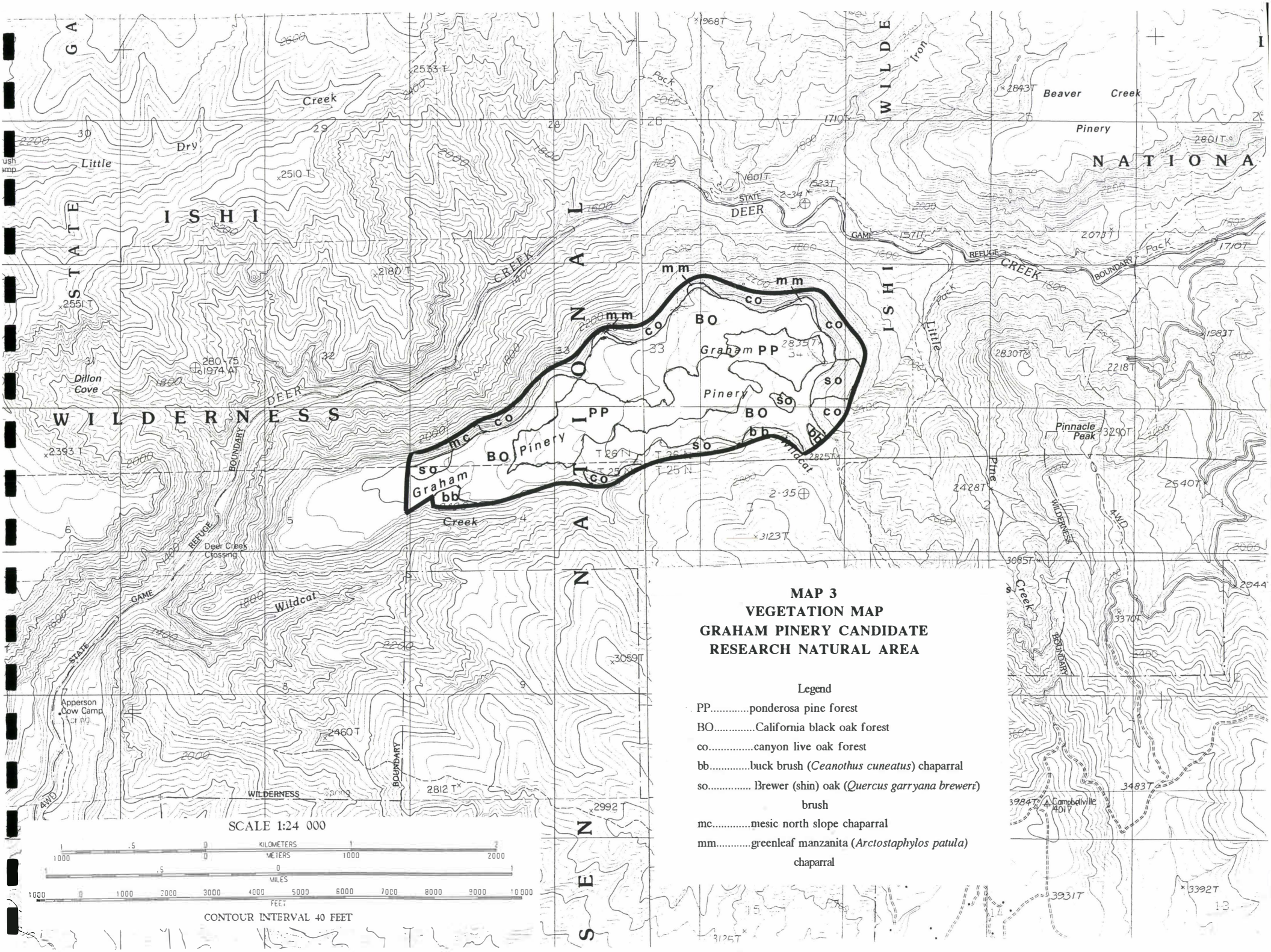
mm.....greenleaf manzanita (*Arctostaphylos patula*) chaparral

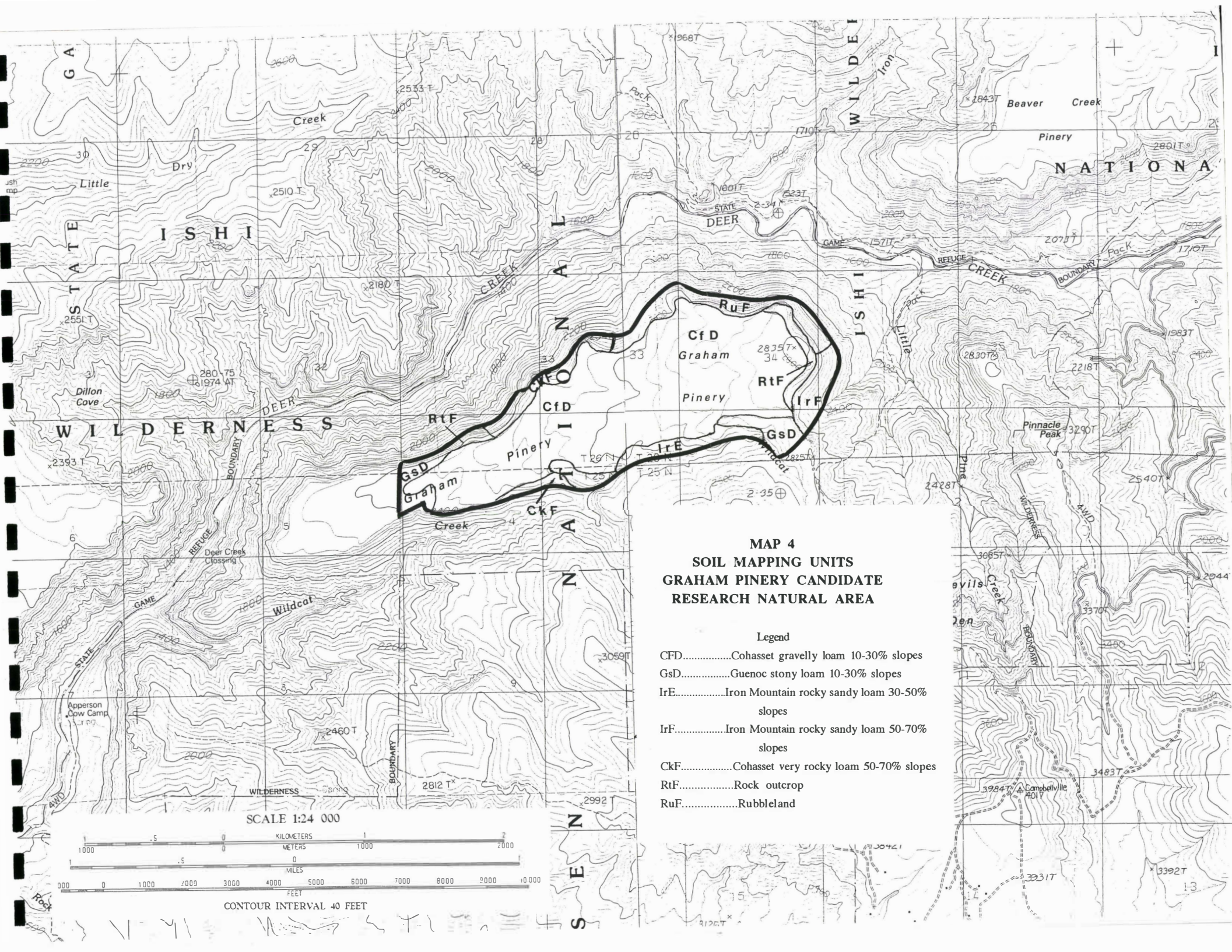
MAP 4

MAP 1
LOCATION AND TRANSPORTATION GRAHAM PINERY CANDIDATE RESEARCH NATURAL AREA




ISHI CAVES, CALIF.
PROVISIONAL EDITION 1986
40121-A7-TF-024
DEVILS PARADE GROUND, CALIF.
PROVISIONAL EDITION 1991
40121-A6-TF-024
MAP 2
THE GRAHAM PINERY CANDIDATE
RESEARCH NATURAL AREA
(as proposed in this report)
SCALE 1:24 000
CONTOUR INTERVAL 40 FEET
Graham Pinery
Graham Creek
Pinery
Beaver Creek
Pinnacle Peak
Devils Den
Dillon Cove
Deer Creek Crossing
Apperson Cow Camp
Campbellville
WILDERNESS BOUNDARY
STATE GAME REFUGE
4WD

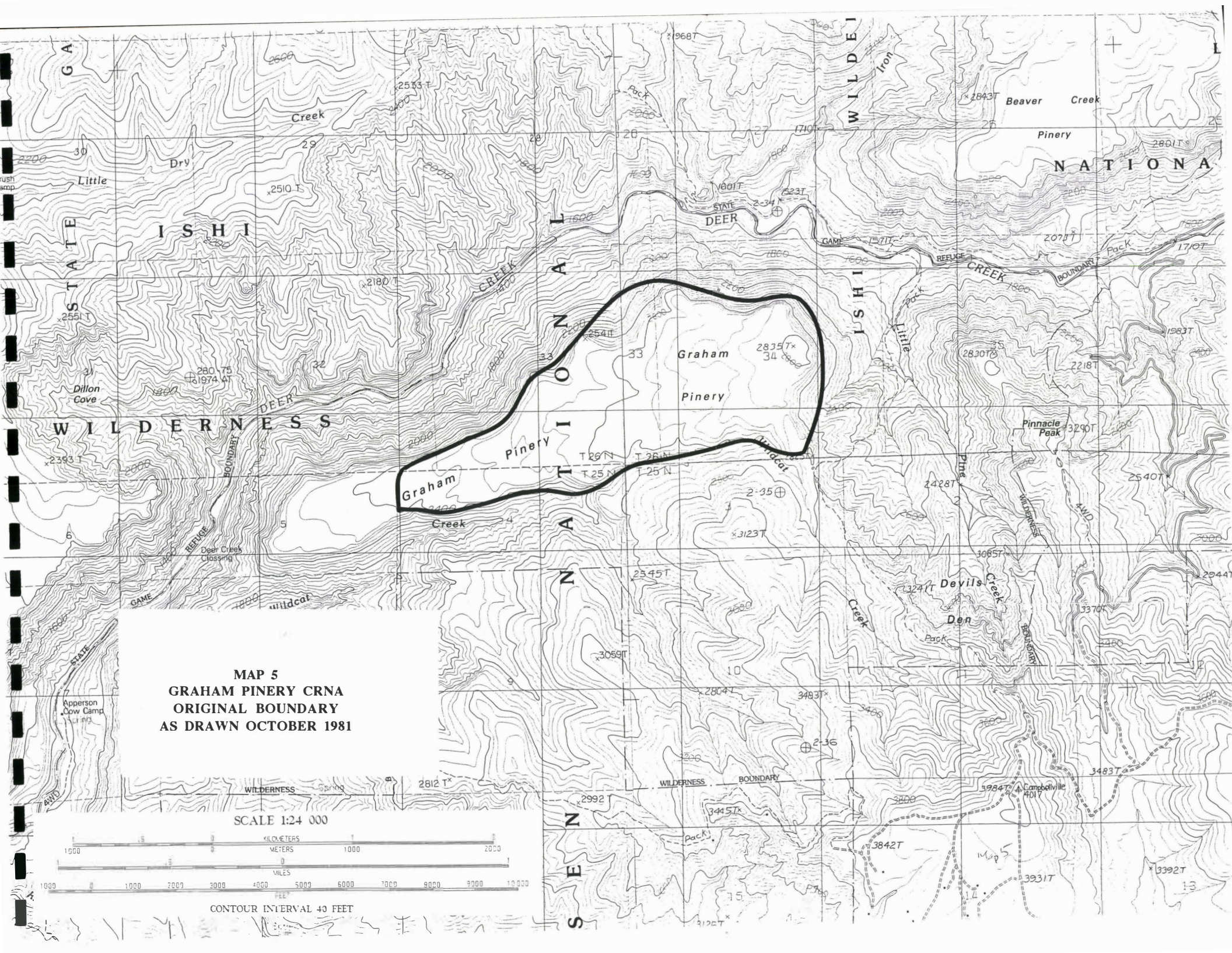

MAP 3
VEGETATION MAP
GRAHAM PINERY CANDIDATE
RESEARCH NATURAL AREA
Legend
PP.....ponderosa pine forest
BO.....California black oak forest
co.....canyon live oak forest
bb.....buck brush (Ceanothus cuneatus) chaparral
so..... Brewer (shin) oak (Quercus garryana breweri) brush
mc.....mesic north slope chaparral
mm.....greenleaf manzanita (Arctostaphylos patula) chaparral
SCALE 1:24 000
KILOMETERS
METERS
MILES
FEET
CONTOUR INTERVAL 40 FEET
Graham PP
Pinery
Deer Creek
Wildcat
Dillon Cove
Pinnacle Peak
Apperson Cow Camp
Deer Creek Crossing
Beaver Creek
Iron Pack
Little Pack
Campbellville
WILDERNESS
BOUNDARY
REFUGE
GAME
STATE
4WD



MAP 4
SOIL MAPPING UNITS
GRAHAM PINERY CANDIDATE
RESEARCH NATURAL AREA

Legend

CFD.....Cohasset gravelly loam 10-30% slopes
GsD.....Guenoc stony loam 10-30% slopes
IrE.....Iron Mountain rocky sandy loam 30-50% slopes
IrF.....Iron Mountain rocky sandy loam 50-70% slopes
CkF.....Cohasset very rocky loam 50-70% slopes
RtF.....Rock outcrop
RuF.....Rubbleland


MAP 5
GRAHAM PINERY CRNA
ORIGINAL BOUNDARY
AS DRAWN OCTOBER 1981
SCALE 1:24 000
KILOMETERS
METERS
MILES
FEET
CONTOUR INTERVAL 40 FEET
Graham
Pinery
Dillon Cove
Deer Creek Crossing
Apperson Cow Camp
Pinnacle Peak
Campbellville
Devils Den
Beaver Creek
Iron Creek
Dry Creek
Little Deer Creek
Wildcat Creek
Pack Creek
WILDERNESS BOUNDARY
REFUGE BOUNDARY
GAME REFUGE
STATE
4WD
NATIONAL FOREST WILDERNESS